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AUTHOR(S): J. A. Cizewski, E. R. Flynn, Ronald E. Brown, and J. W. Sunier

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MASTER

University of California

LOS ALAMOS SCIENTIFIC LABORATORY

Post Office Box 1663 Los Alamos, New Mexico 87545

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TWO-NEUTRON TRANSFER STUDY ON ^{195}Pt.*

J. A. Cizewski, E. R. Flynn, Ronald E. Brown, and J. W. Sunier
Los Alamos Scientific Laboratory, Los Alamos, NM 87545

ABSTRACT

We have investigated the ^{195}Pt(t,p)^{197}Pt reaction. Three states below 1 MeV are populated with a large fraction of the L=0 strength, which is seen in the even to even cases. This is in contrast to other (p,t) and (t,p) studies on Pt targets, where the L=0 strength is concentrated in the ground state.

INTRODUCTION

In two-particle transfer studies one expects to populate strongly states with wave functions that have a large overlap with the target ground state. In odd-A nuclei, where the odd particle is weakly coupled to the even-even core, the (p,t) or (t,p) reaction can be used to identify the core-coupled states[1], since the population pattern will be similar to that of the (p,t) or (t,p) reaction on the even-even core after blocking corrections. Alternatively, two-particle transfer studies are a sensitive probe of transitional regions, because of the fragmentation of L=0 transfer strength observed in these regions. For example, in a spherical-deformed transitional region[2] the levels populated in the final deformed nucleus will be states described by Nilsson orbitals having large components of the spherical-target, ground-state orbital. To probe the A 190 transitional region, we have initiated an investigation of the (t,p) reaction systematics starting with the ^{195}Pt target.

EXPERIMENTAL PROCEDURES

The ^{195}Pt(t,p) reaction was investigated with a 17-MeV triton beam from the LASL Tandem Van de Graaff accelerator. The reaction protons were detected by a helical proportional counter[3] in the focal plane of the Q3D spectrometer.[4] The levels in ^{197}Pt below 1 MeV populated in the present study are indicated by an X in Figure 1, which summarizes the information known[5-8] about low-lying negative-parity levels in ^{193,195,197}Pt. The $1/2^-$ states in ^{197}Pt at 0, 131 and 748 keV are populated by L=0 transitions with cross sections at 25^{0} of 103, 20, and 30 μb/sr, respectively. In Table I we summarize the systematics[8,9] of relative ground-state, L=0 transitions from Pt(t,p) and (p,t) reaction studies. We have also indicated the summed L=0 strength below 1 MeV for ^{195}Pt(t,p).

DISCUSSION

Figure 1 indicates the differences between ^{197}Pt and ^{193,195}Pt. In ^{197}Pt three low-lying $1/2^-$ states have been identified, as opposed to only one in ^{195,193}Pt, and all three of these

TABLE I: Relative Ground-State Transition Strengths for Two Neutron Transfer Studies on Pt Nuclei.[a]

	TARGET				
	^{192}Pt	^{194}Pt	^{195}Pt	^{196}Pt	^{198}Pt
(p,t)	111	100	50	97	98.5
(t,p)	92	100	28 (42)	97	88

[a] The data are from ref. 8, 9 and the present study. For the ^{195}Pt target the summed L = 0 strength below 1 MeV is given in parentheses.

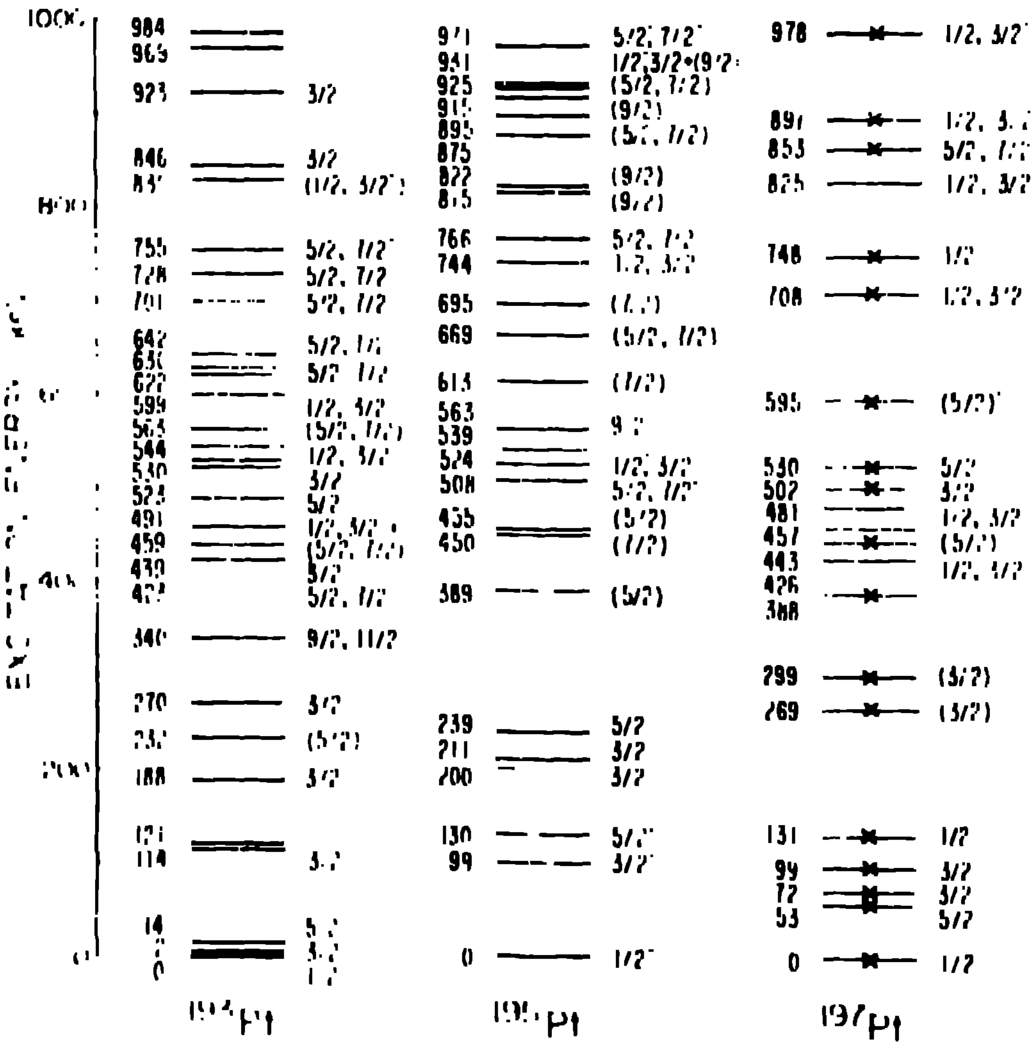

Figure 1. Negative-parity states in $^{193,195,197}Pt$.

states have wave functions with sizeable overlap with the ^{195}Pt ground state, since they are all populated quite strongly in the (t,p) reaction. In the even Pt(t,p) and (p,t) reactions[8-10] almost all of the L=0 strength goes to the ground state (as is also the case for ^{195}Pt(p,t)), with no excited state receiving more than 10 of the ground-state strength, and excited 0^+ states typically are above 1 MeV in excitation. Therefore, the $1/2^-$ states in ^{197}Pt are not simple core-coupled excitations.

The Pt nuclei are in an intermediate region between well-deformed and spherical nuclei. ^{195}Pt has frequently[6] been described within an oblate framework, but if ^{197}Pt were less deformed than ^{195}Pt, one would expect fewer rather than more $1/2^-$ states. In fact, in a Nilsson-model description one cannot account for three low-lying $1/2^-$ states. The fragmentation of single-particle strength in Hf-W-Os nuclei has recently been understood as resulting from changes in the hexadecapole and quadrupole deformations of these nuclei. The even-even Pt cores, however, are exhibiting a quite stable structure[9], except possibly for ^{198,200}Pt. Therefore, traditional approaches such as the Nilsson model, even accounting for fragmentation of single-particle strength as was done in ref. 11, seem to be inadequate to describe the ^{197}Pt level structure. A more complete investigation of the (t,p) and (p,t) reactions in the A 190 nuclei, especially with N 120, and additional knowledge of ^{199}Pt, will be necessary before a good understanding of these nuclei will be possible.

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